CLAIMS

SUB A17

1.   A data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, characterized in that

start address information for an unrecorded area existing in a volume space is recorded in the volume space as part of root directory file management information.

2.   A data storage medium as described in claim 1, wherein said start address information is recorded using an indirect entry for managing a root directory file recording area.

3.   A data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, characterized in that

invalid data not used for retrieving volume/file structure is recorded added before and after volume/file structure and a data file; and

invalid extent management information for managing an invalid data recording area is recorded in the volume space as part of root directory file management information.

4.	A data storage medium as described in claim 3, wherein invalid extent management information is recorded using an allocation descriptor for managing a root directory file recording area.

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5.	A data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, characterized in that

10	root directory file management information is plurally recorded as main chaining information. and reserve chaining information;

address information of an area where main chaining information and reserve chaining information are recorded at a

15	beginning of a volume space is recorded as part of a file set descriptor; and

address information of an area where main chaining information and reserve chaining information is update recorded is recorded as part of main chaining information and reserve chaining

20	information.

6.	A data recording method for performing a formatting process on a data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data

25	recording operations to a same area is limited, comprising:

a chaining information recording step for recording start address information for an unrecorded area existing in a volume space as part of root directory file management information.

5   7.   A data recording method as described in claim 6, wherein the chaining information recording step records start address information for an unrecorded area using an indirect entry for managing a root directory file recording area.

10   8.   A data recording method for performing a formatting process on a data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, comprising:

a chaining information recording step for recording

15   invalid data not used for retrieving volume/file structure added before and after volume/file structure and a data file, and

recording invalid extent management information for managing an invalid data recording area as part of root directory file management information.

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9.   A data recording method as described in claim 8, wherein the chaining information recording step records invalid extent management information using an indirect entry for managing a root directory file recording area.

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10.   A data recording method for performing a formatting process on a data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, comprising:

5   a file set information recording step for recording as part of a file set descriptor address information for an area where main chaining information and reserve chaining information are recorded at a beginning of a volume space; and

              a chaining information recording step for plurally
10   recording main chaining information and reserve chaining information having address information of an area where root directory file management information and main chaining information and reserve chaining information are update recorded.

15   11.   A data recording apparatus for performing a formatting process on a data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, comprising:

              a chaining information recording means for recording
20   start address information for an unrecorded area existing in a volume space as part of root directory file management information.

12.   A data recording apparatus as described in claim 11, wherein the chaining information recording means records start
25   address information for an unrecorded area using an indirect entry

for managing a root directory file recording area.

13.   A data recording apparatus for performing a formatting

process on a data storage medium for recording and reproducing a

5   file managed using a volume/file structure where a number of data

recording operations to a same area is limited, comprising:

a chaining information recording means for recording

invalid data not used for retrieving volume/file structure added

before and after volume/file structure and a data file, and

10   recording invalid extent management information

for managing an invalid data recording area as part of root

directory file management information.

14.   A data recording apparatus as described in claim 13,

15   wherein the chaining information recording means records invalid

extent management information using an indirect entry for

managing a root directory file recording area.

15.   A data recording apparatus for performing a formatting

20   process on a data storage medium for recording and reproducing a

file managed using a volume/file structure where a number of data

recording operations to a same area is limited, comprising:

a file set information recording means for recording as

part of a file set descriptor address information for an area where

25   main chaining information and reserve chaining information are

recorded at a beginning of a volume space; and

a chaining information recording means for plurally recording main chaining information and reserve chaining information having address information of an area where root directory file management information and main chaining information and reserve chaining information are update recorded.

16. A data recording method for performing a file recording process on a data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, comprising:

a chaining information recording step for recording start address information for an unrecorded area existing in a volume space as part of root directory file management information.

17. A data recording method as described in claim 16, wherein the chaining information recording step records start address information for an unrecorded area using an indirect entry for managing a root directory file recording area.

18. A data recording method for performing a file recording process on a data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, comprising:

a chaining information recording step for recording

invalid data not used for retrieving volume/file structure added before and after volume/file structure and a data file, and

recording invalid extent management information for managing an invalid data recording area as part of root

5   directory file management information.

19.   A data recording method as described in claim 18, wherein the chaining information recording step records invalid extent management information using an indirect entry for

10   managing a root directory file recording area.

20.   A data recording method for performing a file recording process on a data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data

15   recording operations to a same area is limited, comprising:

a file set information reproducing step for reproducing address information of an area where main chaining information and reserve chaining information are recorded at a beginning of a volume space using a file set descriptor;

20   a chaining information recording step for reproducing, using main chaining information or reserve chaining information, following main chaining information or reserve chaining information, or root directory file management information; and

a chaining information recording step for plurally

25   recording main chaining information and reserve chaining

information having address information of an area where root directory file management information and main chaining information and reserve chaining information are update recorded.

5   21.   A data recording apparatus for performing a file recording process on a data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, comprising:

10   a chaining information recording means for recording start address information for an unrecorded area existing in a volume space as part of root directory file management information.

22.   A data recording apparatus as described in claim 21, 15   wherein the chaining information recording means records start address information for an unrecorded area using an indirect entry for managing a root directory file recording area.

23.   A data recording apparatus for performing a file 20   recording process on a data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, comprising:

a chaining information recording means for recording 25   invalid data not used for retrieving volume/file structure added

before and after volume/file structure and a data file, and

recording invalid extent management information for managing an invalid data recording area as part of root directory file management information.

24.   A data recording apparatus as described in claim 23, wherein the chaining information recording means records invalid extent management information using an indirect entry for managing a root directory file recording area.

25.   A data recording apparatus · for performing a file recording process on a data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, comprising:

a file set information reproducing means for reproducing address information of an area where main chaining information and reserve chaining information are recorded at a beginning of a volume space using a file set descriptor;

a chaining information recording means for reproducing, using main chaining information or reserve chaining information, following main chaining information or reserve chaining information, or root directory file management information; and

a chaining information recording means for plurally recording main chaining information and reserve chaining

information having address information of an area where root directory file management information and main chaining information and reserve chaining information are update recorded.

5   26.   A data reproducing method for performing a file reproducing process from a data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, comprising:

10   a file set information reproducing step for reproducing address information for an area where main chaining information and reserve chaining information are recorded at a beginning of a volume space using a file set descriptor; and

a chaining information recording step for reproducing, 15   using main chaining information or reserve chaining information, following main chaining information or reserve chaining information, or root directory file management information.

27.   A data reproducing apparatus for performing a file 20   reproducing process from a data storage medium for recording and reproducing a file managed using a volume/file structure where a number of data recording operations to a same area is limited, comprising:

a file set information reproducing means for 25   reproducing address information for an area where main chaining

information and reserve chaining information are recorded at a beginning of a volume space using a file set descriptor; and

a chaining information recording means for reproducing, using main chaining information or reserve chaining information, following main chaining information or reserve chaining information, or root directory file management information.